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10/067,927	02/06/2002	Lawrence A. Ray	82782DMW	8963

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EXAMINER	
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ART UNIT	PAPER NUMBER
2612	

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/067,927	RAY ET AL.	
	Examiner	Art Unit	
	Nelson D. Hernandez	2612	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *06 February 2002*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-28* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-28* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *22 April 2002* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *2/6/02 & 5/14/03*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims **1-3**, **5-8**, **11-14**, **17-24**, **26** and **27** are rejected under 35 U.S.C. 103(a) as being unpatentable over Ray et al. ("Approaches to Color Scannerless Range System", 3-D Digital Imaging and Modeling, 2001 Proceedings) in view of Fontenot et al., US Patent 5,910,816.

Regarding **claim 1**, Ray discloses a color scannerless range imaging system (See fig. 1) for capturing both color and range information (See figs. 2-4) from illumination reflected from a scene, said color scannerless range imaging system comprising: an illumination system (See flash in fig. 1 and IR illuminator in fig. 2) for illuminating the scene with modulated illumination of a predetermined modulation frequency, whereby some of the modulated illumination is reflected from objects in the scene (Pages 21 and 22, Topic 2, SRI System Fundamentals; page 23, topic 3, Color using Parallel Cameras); an image intensifier (See image intensifier in fig. 3) receiving the reflected illumination and including a modulating stage for modulating the reflected modulated illumination from the scene with the predetermined modulation frequency, thereby generating phase images from which the range information is obtained (Pages 21 and 22, Topic 2, SRI System Fundamentals; page 23-24, Topic 4, Color Using Two

Image Planes); and an image capture system (See fig. 3) including an image responsive element (CCD) for capturing a plurality of images output by the image intensifier (See image intensifier in fig. 3), including (a) a plurality of phase images corresponding to the reflected modulated illumination, whereby the modulation of the reflected modulated illumination incorporates a phase delay corresponding to the distance of objects in the scene from the range imaging system, and (b) a plurality of color images of reflected unmodulated illumination corresponding to color in the scene (Pages 21 and 22, Topic 2, SRI System Fundamentals; page 23-24, Topic 4, Color Using Two Image Planes). Ray also discloses using a lens turret having a portion with the scannerless range imaging system for capturing the range information of the image and a standard lens for capturing the texture image (Page 24, Topic 5, Color Using Selectable Lens) but does not explicitly disclose a sequentially selectable color filter arrangement positioned in an optical path of the reflected illumination and comprised of a first color filter that preferentially transmits the reflected modulated illumination and a plurality of other color filters that preferentially transmit reflected unmodulated illumination and a control system for driving the color filter arrangement to sequentially provide each of the color filters in the optical path.

However, Fontenot teaches a system (Fig. 4) for independently processing visible and infrared light, said system comprises a color filter arrangement (Figs. 4: 54 and 5: 54) positioned in an optical path of the reflected illumination and comprised of a first color filter that preferentially transmits the reflected IR illumination and a plurality of other color filters (Red, Green and Blue) that preferentially transmit reflected

unmodulated illumination and a control system (Fig. 4: 60) for driving the color filter arrangement (Using Motor in fig. 4: 58) to sequentially provide each of the color filters in the optical path so as to process each light signal independently using only one imaging device (Fig. 4: 52) (Col. 7, lines 21-58; col. 8, lines 12-23).

Therefore, taking the combined teaching of Ray in view of Fontenot as a whole, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Ray by using a color filter arrangement positioned in an optical path of the reflected illumination and comprised of a first color filter that preferentially transmits the reflected modulated illumination to the image intensifier and a plurality of other color filters (Red, Green and Blue) that preferentially transmit reflected unmodulated illumination and a control system for driving the color filter arrangement to sequentially provide each of the color filters in the same optical path so as to process each light signal independently using only one imaging device. The motivation to do so would reduce the cost of and avoid the image inversion and registration problems of a prism based system as suggested by Fontenot (Col. 8, lines 12-23).

Regarding **claim 2**, Ray discloses that the range imaging system comprises a micro-channel plate (See figs. 3 and 4; see also pages 21 and 22, Topic 2, SRI System Fundamentals).

Regarding **claim 3**, the combined teaching of Ray in view of Fontenot as applied to claim 1 teaches that image intensifier is interposed in the optical path between the image responsive element and the color filter arrangement. Therefore, grounds for rejecting claim 1 apply here.

Regarding **claim 5**, Ray discloses that the image responsive element is an electronic image sensor (CCD) (Pages 21 and 22, Topic 2, SRI System Fundamentals; page 23-24, Topic 4, Color Using Two Image Planes).

Regarding **claim 6**, Ray discloses means for storing the color and phase image as a bundle of associated images (Page 23, Topic 3, Color Using Parallel Cameras).

Regarding **claim 7**, Ray discloses that the image responsive element captures a plurality of phase images corresponding to the reflected modulated illumination, wherein each phase image incorporates the effect of the predetermined modulation frequency together with a phase offset unique for each image (Pages 21 and 22, Topic 2, SRI System Fundamentals; page 23-24, Topic 4, Color Using Two Image Planes).

Regarding **claim 8**, Ray discloses that the phase offset θ is given by $\theta_i = \frac{2\pi i}{3}; i = 0,1,2$ (Page 22, col. 2).

Regarding **claim 11**, the combined teaching of Ray in view of Fontenot as applied to claim 1 teaches that the predetermined modulating frequency is an infra-red frequency and said first color filter is an infra-red filter (See Ray, IR illuminator in fig. 2, page 23, topic 3, Color using Parallel Cameras; see also Fontenot, col. 7, lines 21-58; col. 8, lines 12-23).

Regarding **claim 12**, the combined teaching of Ray in view of Fontenot as applied to claim 1 teaches that the other color filters comprise red, green and blue filters. Grounds for rejecting claim 1 apply here.

Regarding **claim 13**, Ray teaches that the illumination system (See flash in figs. 1 and 2) also emits unmodulated illumination and the reflected unmodulated illumination

includes at least some of the emitted unmodulated illumination, the use of unmodulated illumination is necessitated to capture the color signal (Pages 21 and 22, Topic 2, SRI System Fundamentals; page 23-24, Topic 4, Color Using Two Image Planes).

Regarding **claim 14**, Ray discloses that the reflected unmodulated illumination includes ambient illumination reflected from objects in the scene (Pages 21-23, Topic 2, SRI System Fundamentals).

Regarding **claim 15**, the combined teaching of Ray in view of Fontenot as applied to claim 1 teaches that the color filter arrangement is a color filter wheel. Grounds for rejecting claim 1 apply here.

Regarding **claim 17**, Ray discloses a method for capturing both color and range information from illumination reflected from a scene, said method comprising the steps of: illuminating the scene (See fig. 1 and IR illuminator in fig. 2) with modulated illumination of a predetermined modulation frequency, whereby some of the modulated illumination is reflected from objects in the scene (Pages 21 and 22, Topic 2, SRI System Fundamentals; page 23, topic 3, Color using Parallel Cameras); using an image intensifier (See image intensifier in fig. 3) to modulate the reflected modulated illumination from the scene with the predetermined modulation frequency, thereby generating phase images from which range information is obtained (Pages 21 and 22, Topic 2, SRI System Fundamentals; page 23-24, Topic 4, Color Using Two Image Planes); and capturing a plurality of images output by the image intensifier, including (a) a plurality of phase images corresponding to the reflected modulated illumination when the first color filter is provided in the optical path, whereby the modulation of the

reflected modulated illumination incorporates a phase delay corresponding to the distance of objects in the scene from the range imaging system, and (b) a plurality of color images of reflected unmodulated illumination corresponding to color in the scene when the other color filters are provided in the optical path (Pages 21 and 22, Topic 2, SRI System Fundamentals; page 23-24, Topic 4, Color Using Two Image Planes). Ray also discloses using a lens turret having a portion with the scannerless range imaging system for capturing the range information of the image and a standard lens for capturing the texture image (Page 24, Topic 5, Color Using Selectable Lens) but does not explicitly disclose sequentially positioning an arrangement of color filters in an optical path of the reflected illumination including a first color filter that preferentially transmits the reflected modulated illumination and a plurality of other color filters that preferentially transmit reflected unmodulated illumination.

However, Fontenot teaches a system and method (Fig. 4) for independently processing visible and infrared light, said system comprises a color filter arrangement (Figs. 4: 54 and 5: 54) positioned in an optical path of the reflected illumination and comprised of a first color filter that preferentially transmits the reflected IR illumination and a plurality of other color filters (Red, Green and Blue) that preferentially transmit reflected unmodulated illumination and a control system (Fig. 4: 60) for driving the color filter arrangement (Using Motor in fig. 4: 58) to sequentially provide each of the color filters in the optical path so as to process each light signal independently using only one imaging device (Fig. 4: 52) (Col. 7, lines 21-58; col. 8, lines 12-23).

Therefore, taking the combined teaching of Ray in view of Fontenot as a whole, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Ray by using a color filter arrangement positioned in an optical path of the reflected illumination and comprised of a first color filter that preferentially transmits the reflected modulated illumination to the image intensifier and a plurality of other color filters (Red, Green and Blue) that preferentially transmit reflected unmodulated illumination and a control system for driving the color filter arrangement to sequentially provide each of the color filters in the same optical path so as to process each light signal independently using only one imaging device. The motivation to do so would reduce the cost of and avoid the image inversion and registration problems of a prism based system as suggested by Fontenot (Col. 8, lines 12-23).

Regarding **claim 18**, Ray discloses storing the color and phase image as a bundle of associated images (Page 23, Topic 3, Color Using Parallel Cameras).

Regarding **claim 19**, Ray discloses that the plurality of phase images are captured corresponding to the reflected modulated illumination, and each phase image incorporates the effect of the predetermined modulation frequency together with a phase offset unique for each image (Pages 21 and 22, Topic 2, SRI System Fundamentals; page 23-24, Topic 4, Color Using Two Image Planes).

Regarding **claim 20**, Ray discloses that each unique phase offset θ is given by $\theta_i = \frac{2\pi i}{3}; i = 0,1,2$ (Page 22, col. 2).

Regarding **claim 21**, the combined teaching of Ray in view of Fontenot as applied to claim 17 teaches that the predetermined modulating frequency is an infra-red

frequency and said first color filter is an infra-red filter (See Ray, IR illuminator in fig. 2, page 23, topic 3, Color using Parallel Cameras; see also Fontenot, col. 7, lines 21-58; col. 8, lines 12-23).

Regarding **claim 22**, the combined teaching of Ray in view of Fontenot as applied to claim 17 teaches that the other color filters comprise red, green and blue filters. Grounds for rejecting claim 17 apply here.

Regarding **claim 23**, Ray teaches that the step of illuminating the scene (Using flash in figs. 1 and 2) also emits unmodulated illumination and the reflected unmodulated illumination includes at least some of the emitted unmodulated illumination, the use of unmodulated illumination is necessitated to capture the color signal (Pages 21 and 22, Topic 2, SRI System Fundamentals; page 23-24, Topic 4, Color Using Two Image Planes).

Regarding **claim 24**, the combined teaching of Ray in view of Fontenot as applied to claim 17 teaches that the arrangement of color filters is provided in a color filter wheel. Grounds for rejecting claim 17 apply here.

Regarding **claim 26**, Ray discloses an attachment for a camera system (See fig. 1) for capturing both color and phase information from illumination reflected from a scene (See figs. 2-4), said camera system including an illumination system (See flash in fig. 1 and IR illuminator in fig. 2) for illuminating the scene with modulated illumination of a predetermined modulation frequency, whereby some of the modulated illumination is reflected from objects in the scene, and an image responsive element (CCD) for capturing the reflected illumination (Pages 21 and 22, Topic 2, SRI System

Fundamentals; page 23, topic 3, Color using Parallel Cameras) said attachment comprising: an image intensifier (See image intensifier in fig. 3) receiving the reflected illumination and including a modulating stage for modulating the reflected modulated illumination from the scene with the predetermined modulation frequency, thereby generating the phase information, whereby the image responsive element captures a plurality of images output by the image intensifier, including (a) a plurality of phase images corresponding to the reflected modulated illumination, whereby the modulation of the reflected modulated illumination incorporates a phase delay corresponding to the distance of objects in the scene from the range imaging system, and (b) a plurality of color images of reflected unmodulated illumination corresponding to color in the scene (Pages 21 and 22, Topic 2, SRI System Fundamentals; page 23-24, Topic 4, Color Using Two Image Planes). Ray also discloses using a lens turret having a portion with the scannerless range imaging system for capturing the range information of the image and a standard lens for capturing the texture image (Page 24, Topic 5, Color Using Selectable Lens) but does not explicitly disclose a sequentially selectable color filter arrangement positioned in an optical path of the reflected illumination and comprised of a first color filter that preferentially transmits the reflected modulated illumination and a plurality of other color filters that preferentially transmit reflected unmodulated illumination; a control system for driving the color filter arrangement to sequentially provide each of the color filters in the optical path.

However, Fontenot teaches a system (Fig. 4) for independently processing visible and infrared light, said system comprises a color filter arrangement (Figs. 4: 54

and 5: 54) positioned in an optical path of the reflected illumination and comprised of a first color filter that preferentially transmits the reflected IR illumination and a plurality of other color filters (Red, Green and Blue) that preferentially transmit reflected unmodulated illumination and a control system (Fig. 4: 60) for driving the color filter arrangement (Using Motor in fig. 4: 58) to sequentially provide each of the color filters in the optical path so as to process each light signal independently using only one imaging device (Fig. 4: 52) (Col. 7, lines 21-58; col. 8, lines 12-23).

Therefore, taking the combined teaching of Ray in view of Fontenot as a whole, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Ray by using a color filter arrangement positioned in an optical path of the reflected illumination and comprised of a first color filter that preferentially transmits the reflected modulated illumination to the image intensifier and a plurality of other color filters (Red, Green and Blue) that preferentially transmit reflected unmodulated illumination and a control system for driving the color filter arrangement to sequentially provide each of the color filters in the same optical path so as to process each light signal independently using only one imaging device. The motivation to do so would reduce the cost of and avoid the image inversion and registration problems of a prism based system as suggested by Fontenot (Col. 8, lines 12-23).

Regarding **claim 27**, the combined teaching of Ray in view of Fontenot as applied to claim 26 teaches that the arrangement of color filters is provided in a color filter wheel. Grounds for rejecting claim 26 apply here.

3. Claims **4** and **9** are rejected under 35 U.S.C. 103(a) as being unpatentable over Ray et al. ("Approaches to Color Scannerless Range System", 3-D Digital Imaging and Modeling, 2001 Proceedings) in view of Fontenot et al., US Patent 5,910,816 and further in view of Ray, US Patent 6,118,946.

Regarding **claim 4**, the combined teaching of Ray in view of Fontenot fails to teach that the image responsive element is a photosensitive film.

However, Ray '946 teaches a method and apparatus for scannerless range image capture using photographic film, wherein said apparatus comprises an illumination source (Laser in fig. 2: 24) that can be modulated at a predetermined frequency, a modulation controller (Fig. 2: 26), an image intensifier (Fig. 2: 28), and a frame of photographic film to capture the image from the scene (Col. 4, lines 1-37).

Therefore, taking the combined teaching of Ray in view of Fontenot and further in view of Ray '946 as a whole, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the color scannerless range imaging system by using a photographic film as image responsive element. The motivation to do so would reduce the cost and complexity of the color scannerless range imaging system.

Regarding **claim 9**, the combined teaching of Ray in view of Fontenot and further in view of Ray '946 teaches that the illumination system includes a laser illuminator for producing the modulated illumination (See Ray '946, col. 4, lines 1-37).

4. Claim **10** is rejected under 35 U.S.C. 103(a) as being unpatentable over Ray et al. ("Approaches to Color Scannerless Range System", 3-D Digital Imaging and

Modeling, 2001 Proceedings) in view of Fontenot et al., US Patent 5,910,816 and further in view of Uomori, 2002/0067474 A1.

Regarding **claim 10**, the combination of Ray in view of Fontenot fails to teach that the illumination system includes a plurality of light emitting diodes for producing the modulated illumination.

However, Uomori teaches a three-dimensional measuring method and apparatus wherein a range finder uses a plurality of light emitting diodes (See fig. 2) as illumination means to calculate the distance of an object from the camera (Fig. 1: 1) (Page 2, ¶0018; page 3, ¶0055; page 4, ¶0059-0061).

Therefore, taking the combined teaching of Ray in view of Fontenot and further in view of Uomori as a whole, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the color scannerless range imaging system by using a plurality of light emitting diodes (See fig. 2) as illumination means for producing the modulated illumination. The motivation to do so would help the color scannerless range imaging system to increase the illumination system life since LEDs have long life comparatively than other illumination devices as suggested by Uomori (Page 2, ¶0018).

5. Claims **16**, **25** and **28** are rejected under 35 U.S.C. 103(a) as being unpatentable over Ray et al. ("Approaches to Color Scannerless Range System", 3-D Digital Imaging and Modeling, 2001 Proceedings) in view of Fontenot et al., US Patent 5,910,816 and further in view of Wagner, US Patent 5,528,295.

Regarding **claim 16**, the combination of Ray in view of Fontenot fails to teach that the color filter arrangement is an electro-optically tunable color filter.

However, Wagner teaches the use of electro-optically tunable color filter (Fig. 1: 20 and 22) in a television camera for sequentially provide red, green and blue color field of the image being captured by the image sensor (Fig. 1: 28) (Col. 2, lines 1-64; col. 3, line 31 – col. 4, line 54; col. 5, lines 5-36).

Therefore, taking the combined teaching of Ray in view of Fontenot and further in view of Wagner as a whole, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the color scannerless range imaging system by using an electro-optically tunable color filter to sequentially change the color of the filter in an optical path of the reflected illumination to be captured by the image responsive element. The motivation to do so would help the color scannerless range imaging system to reduce the cost of and avoid the image inversion and registration problems of a prism based system.

Regarding **claim 25**, the combination of Ray in view of Fontenot fails to teach that the arrangement of color filters is provided by an electro-optically tunable color filter.

However, Wagner teaches the use of electro-optically tunable color filter (Fig. 1: 20 and 22) in a television camera for sequentially provide red, green and blue color field of the image being captured by the image sensor (Fig. 1: 28) (Col. 2, lines 1-64; col. 3, line 31 – col. 4, line 54; col. 5, lines 5-36).

Therefore, taking the combined teaching of Ray in view of Fontenot and further in view of Wagner as a whole, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the color scannerless range imaging system by using an electro-optically tunable color filter to sequentially change the color of the filter in an optical path of the reflected illumination to be captured by the image responsive element. The motivation to do so would help the color scannerless range imaging system to reduce the cost of and avoid the image inversion and registration problems of a prism based system.

Regarding **claim 28**, the combination of Ray in view of Fontenot fails to teach that the color filter arrangement is an electro-optically tunable color filter.

However, Wagner teaches the use of electro-optically tunable color filter (Fig. 1: 20 and 22) in a television camera for sequentially provide red, green and blue color field of the image being captured by the image sensor (Fig. 1: 28) (Col. 2, lines 1-64; col. 3, line 31 – col. 4, line 54; col. 5, lines 5-36).

Therefore, taking the combined teaching of Ray in view of Fontenot and further in view of Wagner as a whole, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the color scannerless range imaging system by using an electro-optically tunable color filter to sequentially change the color of the filter in an optical path of the reflected illumination to be captured by the image responsive element. The motivation to do so would help the color scannerless range imaging system to reduce the cost of and avoid the image inversion and registration problems of a prism based system.

Contact

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Nelson D. Hernandez whose telephone number is (571) 272-7311. The examiner can normally be reached on 8:30 A.M. to 6:00 P.M..

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wendy R. Garber can be reached on (571) 272-7308. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Nelson D. Hernandez
Examiner
Art Unit 2612

NDHH
March 10, 2005

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